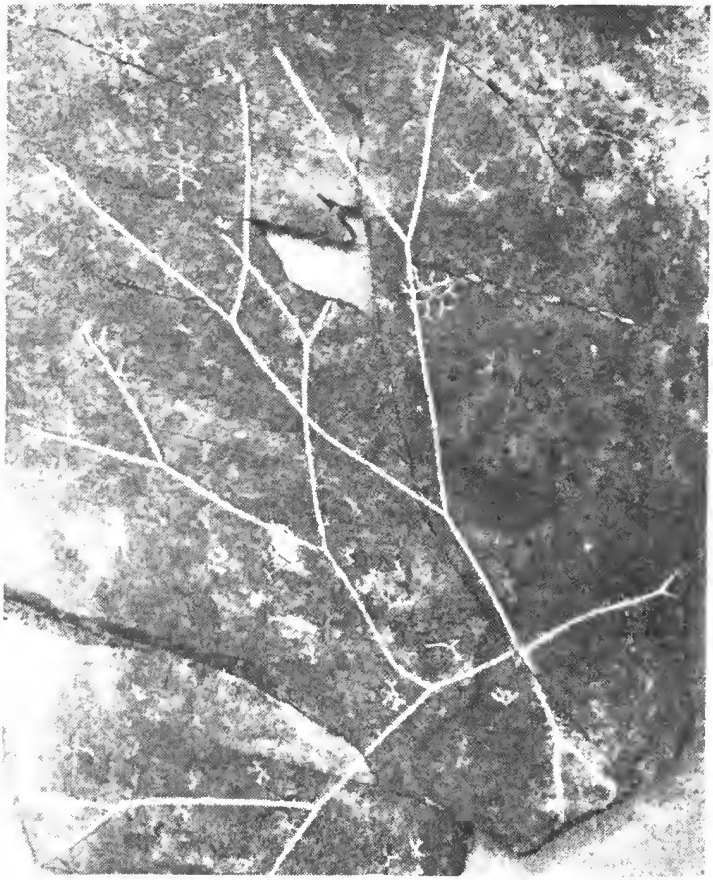
THE FOSSIL COLLECTOR

BULLETIN Nº 24 JANUARY 1988



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THE FOSSIL COLLECTORS ASSOCIATION OF AUSTRALASIA

THE FOSSIL COLLECTORS' ASSOCIATION OF AUSTRALASIA

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EDITORIAL

Even though it will be late January before you read this, I would like to take this opportunity of wishing you all a happy and successful New Year.

It certainly doesn't seem that a year has passed since we pounded out our 21st issue and that all important index. Yet here we are at the end of our eighth year, still going strong, or should I say still managing to get together enough material to produce another Bulletin. It is a pity in some ways that we have to look overseas to fill an issue, particularly in the area of "In the News" and "Books and Book Reviews" but, with a few exceptions, the record in Australia of publishing material of general palaeontological interest in the newspaper/magazine field and of producing books other than in the realm of fossil vertebrates, is to say the least not exactly awe inspiring.

I note in the December edition of"The Fossil Club of New South Wales News" that fellow editor Peter Watson felt it necessary to apologise for the amount of material on dinosaurs that he had included. I sympathise, as nearly all the cuttings from newspapers I have received in the last year relate to dinosaurs. Add this to material in the New Scientist, Scientific American and on the A.B.C's Science Show and one could more than fill an issue of "The Fossil Collector".

Nevertheless we are grateful to palaeontologists like Tom Rich, to be able to include an update on our own "Dinosaur Cove".

On behalf of the Association I would like to thank George Dale for acting as our New South Wales Representative since June 1980.

George has decided to take a long earnt rest and will be replaced by Eric Nowak, who incidentally is also a foundation member of our Association. John Fennell who has recently moved to Tasmania from New Zealand, has agreed to fill the vacancy in the Apple Isle and will, we hope, when he settles in, be able to help with news from that State.

In the next issue we will be including an article on the "*Baragwanathia* Flora", something we have been intending to do for a long time.

Finally, a reminder that subscriptions are due for renewal on March 1st (see following note and enclosed renewal form).

FRANK HOLMES

1988/9 SUBSCRIPTIONS

Over the last three years, during which period subscriptions have remained at $6.00 per annum, the costs of running the F.C.A.A., have increased fairly substantially, particularly in the areas of postage (up 20%), printing, stationery and photo copying.

After consultation between the Secretary and all State Representatives the following subscription rates have been agreed for 1988/89. (All figures quoted in Australian currency)

SURFACE MAIL	Australia and New Zealand	$7.50
	All other countries	$8.50
AIR MAIL	New Zealand	$9.50
	Japan	$11.00
	U.S.A.	$12.00
	U.K. and Europe	$13.00

The differences in the above rates are based purely on current (Oct.1987) postal charges rounded off to the nearest 50 cents.

FINANCES

Statement of finances as at January 10th, 1988.

Carried forward from previous year	$1,185.35
Add income 1.3.1987 to 10.1.1988	1,086.69
	2,272.04
Less expenditure 1.3.1987 to 10.1.1988	796.29
	$1,475.75
Deduct advance subscriptions	142.50
Balance in hand (excluding costs of this Bulletin)	$1,333.25

QUESTIONNAIRE ON THE STRUCTURE OF THE F.C.A.A.

Thirty four members (19 percent) from within Australia and New Zealand, answered the Questionnaire sent out with the September 1987 Bulletin.

In answer to the first question "Are you satisfied with the present organisation of the Association, i.e., a loose association of persons with a common interest without formal constitution or elected office bearers?", thirty two of the thirty four members replied "Yes". However, in addition to the two who believe we should investigate "incorporation" in more than one State (Question 3b.,1) a further two members felt that we should move towards the adoption of a suitable constitution and rules, a prerequisite for incorporation (Question 2).

The feeling of the majority who replied is clearly that we should remain as we are for the time being at least. Indeed many commented on the problems and infighting they had encountered in other organisations with formal constitutions, rules and elected office bearers - they very much appreciate the informality of the F.C.A.A.

Among the many useful comments submitted was the recommendation that the statement at the end of the Questionnaire preamble,namely, "Membership of the Fossil Collectors' Association of Australasia does not give individual members or groups of members any authority to arrange or participate in any field trips, exhibitions or similar activities in the name of the Association, unless so authorised in writing by the Secretary and the State Representative in which the activity is to be held, nor does it infer any rights whatsoever for members to enter upon or collect fossils on any public or private land without the consent of the Authority or Owner having jurisdiction over such land" be included on both the Association's membership application form and the annual renewal notice. This recommendation is now being implemented.

The Secretary wishes to thank members who replied to the Questionnaire and those who offered assistance in one way or another.

A summary of answers to the Questionnaire will be made available to any member on written request to the Secretary.

GEMBOREE 1988 - CANBERRA

An informal meeting of F.C.A.A. members and friends will be held at the Gemboree on FRIDAY 1st. APRIL at 8 p.m. in HALL 'M'. Unfortunately it will be necessary to bring your own chair(s). To be safe, please verify arrangements on arrival.

Frank Holmes will also be giving a lecture on "Australian Tertiary echinoids" on SATURDAY 2nd. APRIL at 2 p.m. in HALL 'N'. We understand this hall does have chairs.

REPORT ON THE SYMPOSIUM ON EARLY VERTEBRATE STUDIES

by Susan Turner, Queensland Museum.

An Australian contingent of five scientists, including three geologists and two palaeozoologists, recently attended the Symposium on Early Vertebrate Studies in China. The five, Professor K.S.W. Campbell and Dr Dick Barwick (ANU), Dr. Gavin Young (BMR), Dr. Sue Turner and Dr. Anne Kemp (Queensland Museum), were the largest foreign contingent to attend the meeting which considered the geological, evolutionary and biological problems concerning our earliest vertebrate ancestors.

The Symposium was held from October 12th-25th, first in the Beijing suburb of Fangshan and then in Yunnan Province. It was sponsored by the Palaeontological Society of China, the Society of Vertebrate Palaeontology of China and the Institute of Vertebrate Palaeontology and Paleoanthropology of the Academia Sinica. A team of Palaeozoic fossil fish workers from the IVPP which ran the Symposium was headed by the Director, Chang Mee-mann.

In addition to the 47 official participants at the Symposium, there were some members of the Chinese National Science Foundation, Academia Sinica and official journalists and video cameramen. Of the 47, 24 overseas scientists came from 9 countries, Australia, France, Canada, Britain, USA, Norway, Denmark, USSR and Hong Kong.

A week of animated talks and discussions at Fangshan covered many topics of interest on fossil fishes. Of particular note to Australian geologists was the recurrent theme of the use of Palaeozoic, especially Devonian, fishes in dating rocks, and the potential of vertebrate macro and microfossils for Devonian biostratigraphy, occurring as they do in marine and non-marine sequences. Of extreme importance was the discovery by Lee Cho-Min (Hong Kong Polytechnic) of Devonian fish from Hong Kong, in rocks previously thought to be Jurassic. These topics were reinforced during the fascinating field trip to the Siluro-Devonian sections in the Qujing and Wuding districts of Yunnan, where the Chinese workers showed off their key sites. There was much lively argument on the problems of dating the rocks and correlating them to sites with well-defined invertebrate assemblages.

Overseas geologists stressed the need for the Chinese to publish detailed logs of their sections.

All participants agreed that the scientific sessions, given in English, with liberal use of French and Chinese, were of great value. Some of the nine young Chinese students present gave excellent papers. Much new information was forthcoming on all groups of fishes from China and overseas. Of particular interest were the new

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REPORT ON THE SYMPOSIUM ON EARLY VERTEBRATE STUDIES (Cont.)

materials and interpretation of Ordovician jawless vertebrates. This work by Elliott (USA) and Blieck (France) gives insight into the earliest vertebrates known and increases our understanding of primitive vertebrate characteristics. New Devonian placoderms and lungfish, introduced by Young (Australia), Zhang (Beijing, China), Schultze (USA) and Song (Wuhan, China), emphasised the similarities between China and Australia in Mid-Palaeozoic times.

Following the tradition begun in 1967 at the Nobel Symposium in Stockholm, the Chinese have hosted a highly successful international symposium, the first of its kind in that country. The next date for those interested in Mid-Palaeozoic matters is the Second International Symposium to be held in Tallinn, Estonian S.S.R., in 1989. A firm commitment in the form of an invitation from the Quebec Government for a future meeting to be held at the Miguasha Museum at Gaspe, was given in Beijing by the Director, Marius Arsenault. This Museum, which sits on the protected Devonian section of the Escuminac formation is unique in its dedication to educating the public about fossil fishes.

IN THE NEWS

ANCIENT FROG REAPPEARS IN A BLAZE OF AMBER

A scientist in the U.S.A. has examined a fossilised frog exquisitely preserved in a lump of amber that could be up to 40 million years old.

It is the first documented case of an amphibian found in amber and the oldest complete fossil frog from Mesoamerica, which includes, Mexico, Central America and the Caribbean.

The frog is perfectly preserved, its translucent skin revealing a delicate skeleton. Both its eyes and mouth are open.

Although many fossilised insects have been found in amber, there are only two documented cases in which animals with backbones have been preserved. Both of these are lizards.

A miner in the Dominican Republic found the fossil about a year ago in an amber mine at La Toca. It has since been sold to an amber dealer in Ashland, Oregon who plans to sell the frog at an auction in February. The value of the frog is estimated at $US25,000.

Based on other fossils found in the La Toca area George Poinar of the University of California at Berkeley who has examined tissue from the frog, estimates it to be 35 to 40 million years old.

Adapted from a report in "New Scientist", 10th. September, 1987.

DUCK BILLED DINOSAUR EGGS FOUND IN ALBERTA

One of the most important scientific discoveries reported in 1987 was the discovery in June of the remains of dozens upon dozens of dinosaur eggs in a dry gulch, known as Devil's Coulee in the bad lands of Alberta, Canada, about 200 kms S.E. of Calgary and 40 kms from the United States border. The bones and mature foetuses were found with egg fragments. Although it is too early to tell for sure, scientists from the Tyrrell Museum in nearby Drumheller, are confident that they have stumbled across one of the best collections of dinosaur eggs in the world. A few intact eggs were found in the Gobi Desert of China in the 1920's, but these have undergone only scant scientific scrutiny according to the Canadian palaeontologists. Dinosaur eggs were also found across the border in Montana in the late 1970's, however the Canadians believe that the remains in Devil's Coulee are more extensive and in better condition than those from Montana.

For the past few weeks the scientists have been uncovering dinosaur nests at the rate of one every three or four days. So far more than twenty nests have been unearthed. The excavation work will resume in the Spring when the snow melts. Even to date the nests and the shell and bone fragments they contain have already revealed some fascinating information about how these dinosaurs lived. Already scientists are speculating that the dinosaurs lived in more sophisticated ways than was once thought. The eggs belong to a plant eating dinosaur called a hadrosaur or duck billed dinosaur, although the particular species of hadrosaur is yet to be determined. Adults were up to 13 metres in length and weighed from 4 to 6 tonnes, about the same as a large elephant. They lived in what is now Canada, about 75 million years ago. The way the eggs are stacked, layer upon layer about 30 cms apart, tells scientists, dinosaurs returned to the nesting spot year after year for many hundreds or even thousands of years. That suggests the hadrosaurs lived in colonies or herds that roamed over vast distances returning each year to the nesting site. Many of the baby dinosaurs were about to hatch when they were drowned by flood waters that burst over the banks of rivers that flowed near the nests. The flood waters also deposited a thin sediment that has protected the eggs and foetal remains for millions of years. Traces of vegetation found with the nests suggest that the parents gathered leaves and plants to incubate the eggs and most likely guarded their young like many mammals and birds do today. But the most controversial aspect of the find is that it seems to support the radical idea that dinosaurs were warm blooded, rather than sluggish cold blooded animals that some of the text books would have us believe. Based on shards found so far, the oblong shaped eggs were about 21 cms in length and some 10

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DUCK BILLED DINOSAUR EGGS FOUND IN ALBERTA (Cont.)

cms in diameter. In other words the hadrosaurs were relatively small when they hatched but according to previously found fossils from Alberta and Montana, the animal grew as much as 280 cms in its first year. Such dramatic growth indicates that the hadrosaurs were endothermic or warm blooded. It is also possible that they kept a steady body temperature much like humans do now. An examination of foetal remains which are likely to cover the whole period of foetal development by the time the excavation is finished, will give further clues to the dinosaurs growth rate and hence to its body temperature.

In the coming spring, when the scientists can dig deeper into the rock outcrop about Devil's Coulee they believe they will find a lot more nests and probably some intact or almost intact eggs.

Another report about these North American hadrosaurs was recently published in the journal "Science". Having found remains of them as far north as Alaska, scientists now wonder about the crashing asteroid theory of dinosaur extinction. To exist so far north these hadrosaurs must have been able to stand cold winters and long periods of darkness, the very conditions a catastrophic impact would have created and which some think killed off dinosaurs 65 million years ago.

Another theory of dinosaur extinction recently proposed by scientists from the Massachusetts Institute of Technology, blames acid rain caused by a comet hitting the earth.

The above article is based on a transcript of a report by Ian Anderson in the Australian Broadcasting Commission's "Science Show", Saturday 10th. Oct., 1987.

KOALA JAW FOUND

The jawbone of a koala, thought to be almost 40,000 years old, has been found in a cave near Augusta, Western Australia.

The finder, F.C.A.A. member Lindsay Hatcher of Perth, said he found the bone while exploring the cave with another Perth caver, Alex Saar, and a group of teachers from Albany High School. It was buried in half a meter of sand under a large boulder.

Also found were bones from a number of other animals long extinct in Western Australia; the thylacine, Tasmanian devil, and the giant browsing kangaroo *Sthenurus*.

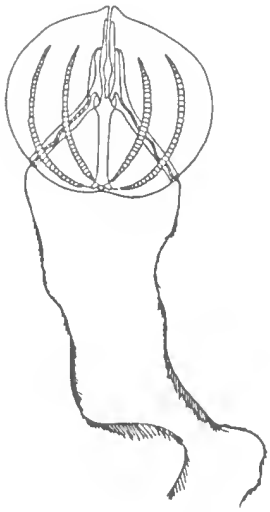
Scientists do not know the exact time the koala became extinct in W.A., but it is believed to have disappeared at least 37,000 years ago.

THE WESTERN AUSTRALIAN 14th. December, 1987.

ANCIENT JELLY PLUGS A GAP IN THE FOSSIL RECORD

The fossil record is full of gaps because, with rare exceptions, only the hard parts of animals are preserved. Almost nothing is known of soft-bodied animals. Recently, however, George Stanley, of the University of Montana, and the West German palaeontologist Wilhelm Sturmer, found what are probably the rarest "fossils" in the world, when they X-rayed samples of Hunsruck Slate. The slate, which dates from the Lower Devonian, 400 million years ago, is famous for its spectacular fossils, some of which show traces of tissues and soft organs.

In 1983, Stanley and Sturmer described a fossil of a comb jelly, a gelatinous animal belonging to the phylum Ctenophora. The ctenophores are tiny, bioluminescent marine animals bearing eight bands of cilia that propel them through the water. The researchers have since found a second specimen which shows more of the comb jelly's delicate structure, including the rows of cilia (comb rows) and what appear to be gonads (Nature, vol 328, p61).



Drawing of an extant comb jelly.

The discovery should help to settle the argument about the relationship between the ctenophores and the Cnidaria (the phylum that includes the hydroids, jellyfish and sea anemones). In the past, taxonomists lumped all these animals together. But comb jellies have a more advanced anatomy and are now assigned to a separate phylum. This led to speculation on the origins of the two groups. Many thought that the ctenophores sprang early from the ancestral stock of the cnidarians. The new fossils push back the age of the ctenophores to establish them as a truly independent phylum.

Without the technique of X-radiography, the fossil would have escaped notice. X-rays pinpointed the comb jelly in the slate, allowing Stanley and Sturmer to make a preparation of the section containing the fossil. They ground the slate to a thin (2 millimetres) section and X-rayed it. The fossil, like most others in the Hunsruck Slate, is flattened. Stereoscopic radiographs "decompressed" the image to give a better idea of the animal's orginal shape.

The new fossil comb jelly, named *Archeocydippida hunsrueckiana*, is 23 millimetres long; it shows a possible mouth, eight comb

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ANCIENT JELLY PLUGS GAP IN FOSSIL RECORD (Cont.)

rows, some with the plates of delicate cilia still visible. Part of one comb row bears clumps of round objects that look like the gonads of living ctenophores. Neither this specimen nor the previous one looks any different from those found today.

Gelatinous animals are so delicate that even today they tend to be overlooked. Hauls from the ocean turn up few comb jellies because they disintegrate in the process. Biologists who dive in submersibles have found that deep waters are teeming with jelly animals. The new fossils hint that this was also true in the Earth's early seas.

"New Scientist", 9th. July 1987.

MUTDAPILLY FOSSIL DISCOVERY

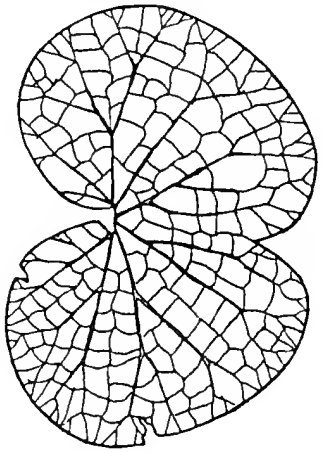
Fossil plants, with their most delicate structure preserved, have recently been found in a new road cutting at Mutdapilly in the Ipswich area of Queensland. This find is expected to give researchers a fresh insight into the complex set of ancient environments preserved in the Jurassic age sediments of the Walloon Coal Measures.

The initial discovery by two Ipswich Grammar School teachers was brought to the attention of the staff of the University of Queensland Geology Museum who, after obtaining permission from the Department of Main Roads, arranged for the recovery of specimens.

The sequence exposed in the Mutdapilly road cut is deeply weathered due to the unstable volcaniclastic mineralogy of the Walloon Coal Measures sediments. Despite this, sedimentologist Dr. Chris. Fielding has identified three lithological units representing three depositional environments in the road cutting. They are a lower fine sandstone/siltstone unit; a middle carbonaceous shale/coal interval; and an upper unit of siltstone.

These have been interpreted as the products of a river channel, swamp and floodplain respectively. Plant fossils were recovered from the uppermost part of the lower unit and are preserved in situ. The fossil site therefore, represents a pioneer plant community of ferns and cycads which grew in abandoned channels as a precursor to swamp development. Sediment built up, covering and compacting the plants so that a cross section of rock from the weathered mass resembles a stack of very thin pancakes.

The most common species found at Mutdapilly is the fern *Cladophlebis australis*. This and the other plant fossils would have been the basic diet of herbivorous dinosaurs of the Jurassic era. Dinosaur footprints have been found before in the Walloon Coal Measures, but so far no skeletal remains have been found.



Hausmannia sp.

Cladophlebis australis

Taeniopteris sp.

Another common fossil at the site is the form genus *Taeniopteris*. These are long narrow parallel sided leaves, with lateral veins at right angles to the margin and a prominent midrib. *Taeniopteris* is believed to be leaves of the cycadophyte *Pentoxylon*. This is a common form of fossil wood found in Queensland Jurassic deposits, that shows multiple wood cylinders in section, usually five cylinders, hence the derivation of the name.

The third most common element is the genus *Hausmannia*, which are distinctive leaves of presumed fern affinity showing radiating venation.

A selection of the hundreds of specimens recovered during the dig are on display at the Geological Museum in the Steele Building, University of Queensland.

Report from the Geology Museum News Letter (Univ. of Queensland) 1987/3

FLUORITE REPLACED FOSSILS

By Alan Goldstein, Curator of Science, Museum of History & Science, Louisville, Kentucky, U.S.A., and Deborah Goldstein.

Fossils can be replaced by a variety of minerals; calcite, aragonite, quartz and pyrite being the four most common. Under varying conditions, other minerals can replace fossils (see Holmes,1986).

Replacement by fluorite (calcium fluoride) is rather rare, occurring only when conditions of alteration are exact.

However, fluorite occurrences in the Kentucky - Indiana - Illinois area of the United States are not uncommon. The area known as "Cave in Rock", a part of the Illinois-Kentucky fluorspar district,

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FLUORITE-REPLACED FOSSILS (Cont.)

has widespread deposits, the fluorite being deposited in vein and bedding replacement at 150 degrees Celcius. Other areas outside this mineral district have fluorite in pockets (scattered, though in pure limestones) that were deposited at lower temperatures (100 degrees Celcius). In these latter areas, fossil replacement has not been found.

Replacement does not occurin the scattered pockets for two major reasons. Firstly, the pockets themselves are very rare, occurring in non-fossiliferous beds. Secondly, the creation of the pockets requires the host rock to be dissolved. This obliterates traces of the fossil(s) where the fluorite crystals form. It is not unusual for a mineralised pocket to occur in stromatoporoid or coral heads, but where mineralisation occurs, the fossils are dissolved away!

Let us examine the conditions where fluorite-replaced fossils can and do occur. Firstly fluorite must be an abundant mineral, so abundant in fact, that wholesale replacement of the rock strata (presumably limestone) is possible. On the other hand, too much replacement obliterates fossils. There must be a balance.

Wall replacement in vein deposits are not favourable for fossil replacement except along the margins of the vein. Bedding replacement where horizontal rock strata are replaced, as compared to narrow vertical veins, are better for fossil preservation (discussed below). We have found that the best fluorite replaced fossils occur in bedding replacement deposits in an area northwest of Cave in Rock, Illinois, called "Spar Mountain". This location is where surface fluorite mining has been carried out. The collecting area is an active quarry and is generally off-limits to collectors, the authors

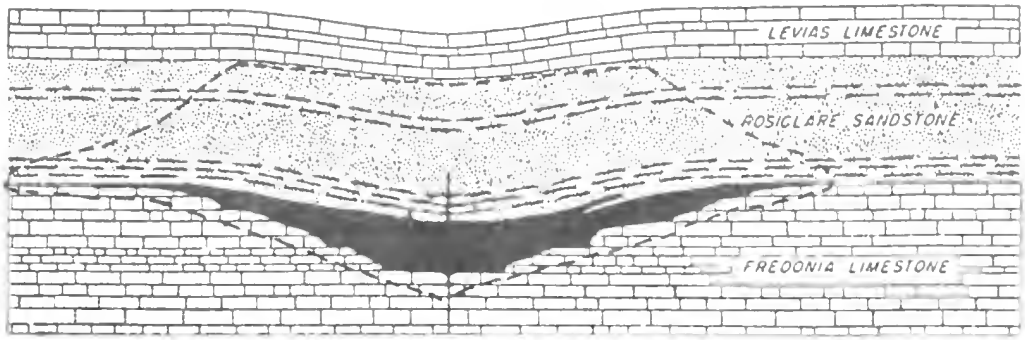

Fig.1. Area where fluorite-replaced fossils may be found (within the dashed line). Impressions are found at the contact with the main fluorite ore body (in black) and the surrounding strata. Modified diagram after Grogan (1949). Scale 1 cm = about 3 metres.

having collected specimens during research and while leading university field trips.

Fluorite rises from deep within the earth along facture and minifault lines and in brecciated tubes. In order for replacement of host rock to occur, a shale layer must be a cap. This dramatically slows vertical solution movement. Spreading laterally, the fluorite replaces the limestone. Vertical fractures allow replacement of calcite in overlying calcareous sandstone beds (when present). Towards the periphery of the deposit, only pure calcite tends to be replaced. This results in the specific replacement of calcite fossils by fluorite and is especially prominent in the sandstone, where the quartz grains are only slightly affected (see figure 1).

Where silicified fossils are involved, the spaces within the fossil may be replaced with massive or crystalline fluorite.

What type of fossils can be replaced? Virtually any fossil is fair game. In the Middle Mississippian (Visean) age, Illinois-Kentucky fluorspar district, the authors have found a variety of replaced fossils, including some rare species. Calices wholly replaced and fluorite-encrusted silicified crinoids have been found. A rare Diploblastus glaber was found attached to a fluorite cube! In addition, the impression of an Orthotetes brachiopod was found on the back of a crystalline mass. It is virtually invisible without a low angle of illumination. Further diligent searches are planned.

In drill cores, cross-sections of fossils filled with fluorite have also been found. One of the most beautiful is a brachiopod partially filled with pale blue fluorite. As fluorite takes up less volume than the calcite it replaces, voids are common.

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Table 1.

Fossils	Mostly Replaced	Partially Replaced
Blastoids		
Pentremites	x	x
Diploblastus	x	
Brachiopods		
Dielasma	x	
Spiriferid	x	x
Composita	x	x
Girtyella	x	x
Orthotetes	(Impression)	
Bryozoans		
Fenestrate	x	
Corals		
Lithostrotion	x	x
Triplophyllites		x
"Zaphrentis"		x
Crinoids		
Stems	x	x
Calyx	x	x

FLUORITE-REPLACED FOSSILS (Cont.)

At a vein mine dump, small fossils in limestone were found to be replaced by sphalerite in non-replaced limestone. This is another example where only pure calcite was re-mineralised.

Although we have not found specimens replaced by barite, conditions of deposition after fluorite were such that the low-grade fluorite was partially replaced by barite. It is of course, possible that barite replaced fossils exist.

Table 1 lists other fluorite-replaced fossils found by the authors.

References

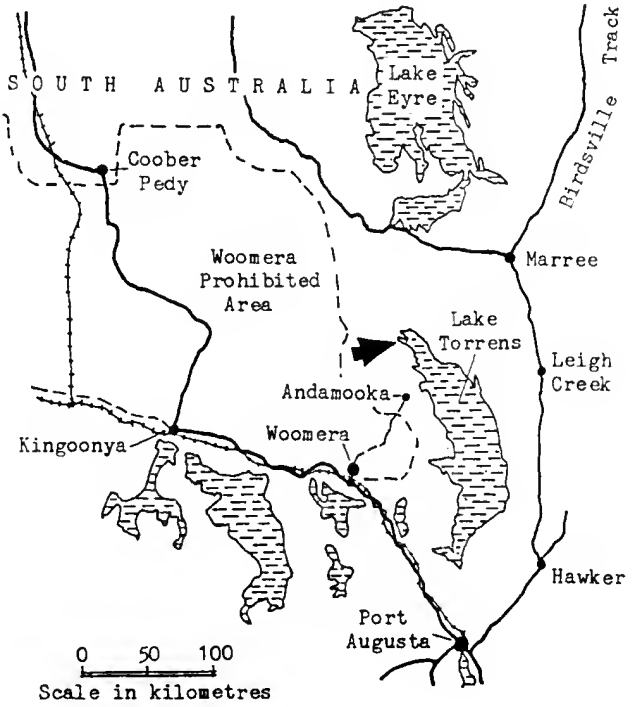
Grogan, R.M., 1949. Structure due to volume shrinkage in the bedding-replacement fluorspar deposits of southern Illinois: Econ.Geology, v.44, no.7, p 606-616.

Holmes, F.C., 1986. Palaeobiological Mineral Deposition and Fossil Pseudomorphs: The Fossil Collector, Bulletin 20, p. 22-30.

RADIOCYATHUS - AN ENIGMA PARTIALLY SOLVED by C.M.Chidley.

A new find of the species *Radiocyathus minor* (Bedford & Bedford) from the Cambrian limestones near Lake Torrens in South Australia, has enabled us at long last to gain a reasonable insight into the macro nature of this rather obscure organism.

"Radiocyathids are enigmatic Lower Cambrian organisms whose exact systematic position is unknown, and which have been assigned various ranks among problematica, these include aberrant archaeocyathids, sponges, echinoderms and perhaps even primitive metazoa."



Previous to this recent find, only small broken portions of the organism were represented in scientific collections throughout the world, thus even the external shape remained unknown, or at best sketchy. With the arrival of the first recently

discovered specimen, now in the collection of the Mining Museum, Sydney (MMF 29217), the upper portion was determined to be slightly flattened hollow ovoid closely resembling *Receptaculites* in nature and possibly possessing a stem at the base.

It was not until the arrival of fifteen or so specimens, now in the author's private collection, that the true macro nature became clear. The organism consists of the above mentioned hollow ovoid, supported by a conical hollow stem, round in section, and showing distinct signs of growth alteration as the growing position of the juvenile organism tilted in the soft mud. No rootlets or holdfasts were detected, which seems to indicate that the juvenile grew simply where it rested, later being partially submerged in the soft mud by its own weight as it reached adulthood. One specimen shows budding as in fig.1. The upper extremity however, still remains a mystery, although the arrival of a number of new specimens has thrown more light upon the subject.

One broken fragment appears to represent the area where one would expect to find the OSCULUM, and indeed, pursing of the apparently flexible structure at this particular point, seems to add to the mystery. Did it have an osculum or not? Was it flexible? Did it have flexible flaps at the crown that act like a valve, similar to those of ARCHAEOCYATHIDS? The specimen seems to suggest this.

This was not all. Detailed examination of the internal and external wall structure has enabled reconstruction with a fair degree of accuracy, the possible water flow paths (fig.2). Water it seems

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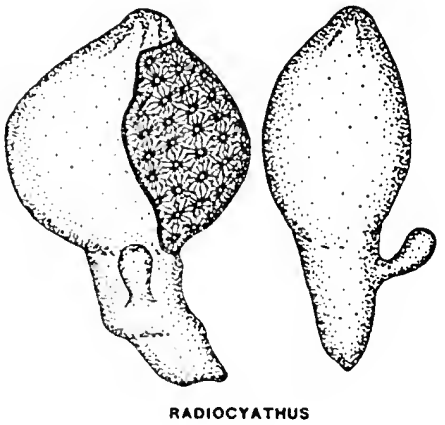

Fig. 1.

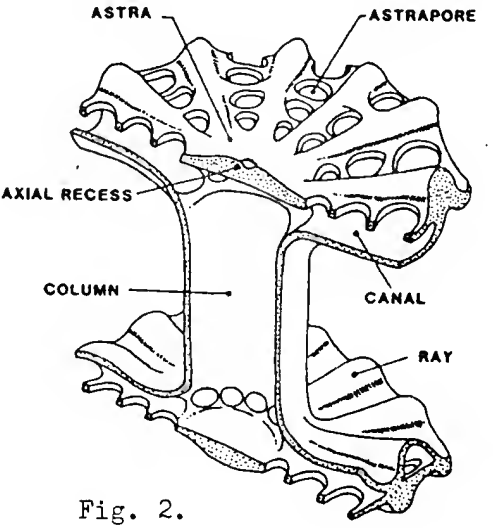

Fig. 2.

RADIOCYATHUS - AN ENIGMA PARTIALLY SOLVED (Cont.)

was drawn into the ASTRAPORES of the outer wall by the pumping action of CILIA cells lining the internal walls of the ASTRA, thence down the central COLUMN that acted as a water conduit and a structural support, and out via the ASTRAPORES of the internal wall into the internal cavity or PARAGASTER. The escape of the water from the organism would have to be via an OSCULUM situated at the crown. Obviously if all this is so, the organism is an animal and not a plant as has previously been postulated.

One thing is still puzzling. What was the reason for the AXIAL RECESS, a small dimple on the top of the ASTRA?

A detailed search seems to have provided the answer. One specimen shows in the matrix, what appears to be the negative imprint of a detached spine. Bayonet shaped, hollow, and about 10 mm long, it appears in the matrix just slightly separated and askew to the outer wall. Was this natures way of protecting one of her most exotic species? It seems that it may have been so - possibly a real Cambrian cactus!

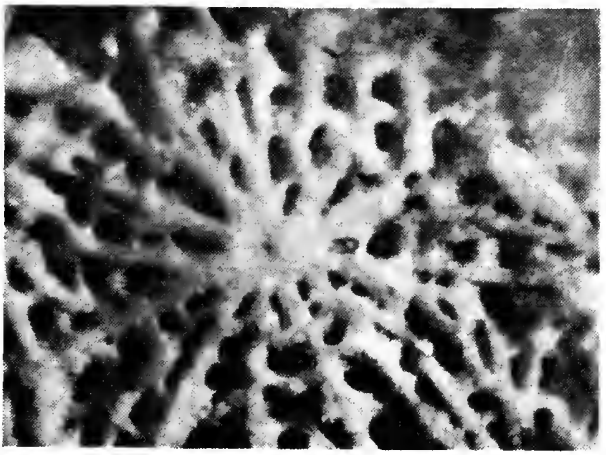

Fig. 3.
Astra x 10.

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NOTE: Drawings and photographs by the author.

AUSTRALIAN PERMIAN BRACHIOPODS by Neil W. Archbold.

PART 2.

The Class Inarticulata and the Strophomenida and Chonetidina of the Class Articulata.

It seems that at least 130 genera of brachiopods are to be found in the marine Permian sequences of Australia and many of them are characterised by numerous species. This article commences an illustrated review of as many genera as possible. There are still a considerable number of species to be described from the Australian Permian and several new genera as well.

Each major group within the two classes of brachiopods will be briefly described, mainly with the aid of line diagrams. Then lists of the genera that occur in the Australian rocks will be commented on and illustrated where possible. General basinal locations and ages will also be indicated (see map in Part 1).

CLASS INARTICULATA

The most primitive of brachiopods belong to the Class Inarticulata. These brachiopods frequently have a chitinophosphatic shell, although some shells are calcareous.

The two valves of the shell are commonly held together only by muscles and the body wall, they are never articulated by hinge teeth and dental sockets. Their time range as a group is Early Cambrian to Recent.

Only two inarticulate brachiopods have been described in modern terms from the Australian marine Permian. They are a species of the circular,

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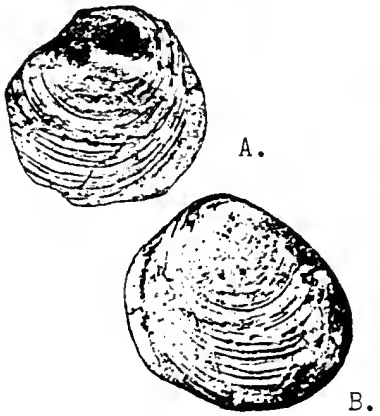

Fig.1. *Orbiculoidea rotularia*
External mould and latex cast from mould. x 2.
Figures from Waterhouse (1986)

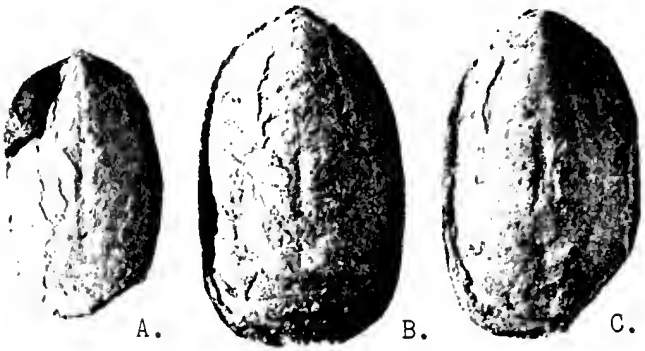

Fig.2. *Lingula occidentaustralis*
Three decorticated shells in dorsal views. All x 3.5.
Figures from Archbold (1981a)

AUSTRALIAN PERMIAN BRACHIOPODS (Cont.)

subconical genus *Orbiculoidia*, described by Waterhouse (1986) from the Early Permian of the Bowen Basin, Queensland,(fig.1) and : A species of *Lingula* from the late Early Permian of the Carnarvon Basin, Western Australia (Archbold, 1981a), (fig.2). Nineteenth Century reports of *Lingula* from the Permian of the Sydney and Bowen Basins have not yet been confirmed by modern investigations.

CLASS ARTICULATA

This Class includes most known brachiopods and it is within the Articulata that some of the most anomalous evolutionary developments took place. The shells are calcareous and invariably demonstrate a well developed hinge region with ventral hinge teeth and dorsal dental sockets. Musculature for opening and closing the valves consists of two well developed sets of muscles; the diductor and adductor sets. Brachiopoda were originally divided into the two classes by T.H. Huxley and the validity of this division is undeniably validated by basic morphological, anatomical and embryological differences among living species.

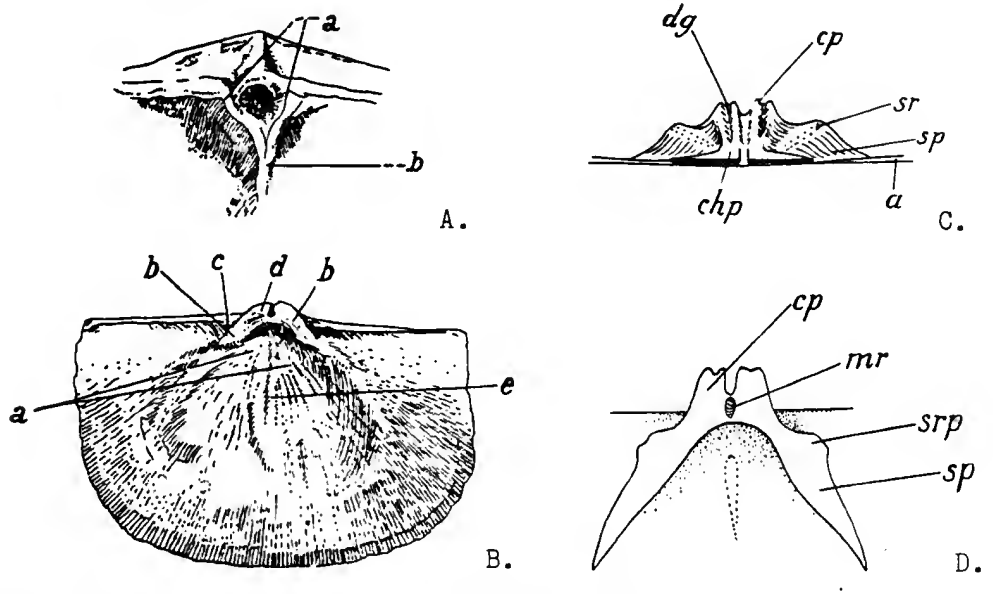

Fig.3. FEATURES OF THE STROPHOMENID SHELL.
A. *Orthotetes*, a = dental plates, b = median septum.
B. *Orthotetes*, a = muscle scar, b = crural plates, c = teeth recesses d = cardinal process, e = septum.
C. *Streptorhynchus*, cardinal process in posterior view and
D. *Streptorhynchus*, cardinal process in anterior view, dg = diductor muscle groove, cp = cardinal process, sr = socket ridge, sp = socket plate, chp = chilidial plate, a = dorsal area, mr = median ridge.
From figures 3 & 6 in Thomas (1958).

As we shall see, the Class Articulata includes numerous diverse orders of brachiopods many of which, in turn, are represented in the Australian marine Permian faunas.

ORDER STROPHOMENIDA

In the "Treatise" volumes, this order included a vast array of brachiopods. Since the writing of those volumes, various groups have been removed from the Strophomenida and recognised by many workers as independent orders in their own right, e.g., the Productida.

Strophomenid brachiopods are biconvex, concavo-convex or resupinate shells with a wide hinge, simple teeth, a usually well developed pseudodeltidium and often finely costellate (ribbed), (fig.3).

While these brachiopods constitute a significant and common component of the Western Australian Permian faunas, they tend to be much rarer in eastern Australia.

The following genera have been described from Australian Permian faunas, see figs. 4 & 5.

Schuchertella : One possible species from the Early Permian of the Bowen Basin and a possible species from the Tasmanian Basin.

Streptorhynchus : Some nine species from Western Australian sequences; one species from the Early Permian of Tasmania and possibly one from the Bowen Basin which may belong in the next genus.

Arctitreta : Two species from W.A. (Carnarvon and Canning Basins); possible species from the Bowen Basin.

Notostrophia : In excess of one species from the Bowen Basin.

Kiangsiella : Several species from W.A., (Carnarvon and Canning Basins).

Derbyia : A rare species from the Late Permian of the Canning and Bonaparte Basins.

Permorthotetes : In excess of six species from the W.A., Permian basins.

References describing the strophomenids include Thomas (1958), Dear (1971) and Waterhouse (1986).

ORDER PRODUCTIDA
SUBORDER CHONETIDINA

This is a distinctive group of generally small brachiopods with a concavo-convex shell and a wide hinge with a row of hinge spines, (fig.6). The group is widely developed in the Western Australian

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AUSTRALIAN PERMIAN BRACHIOPODS (Cont.)

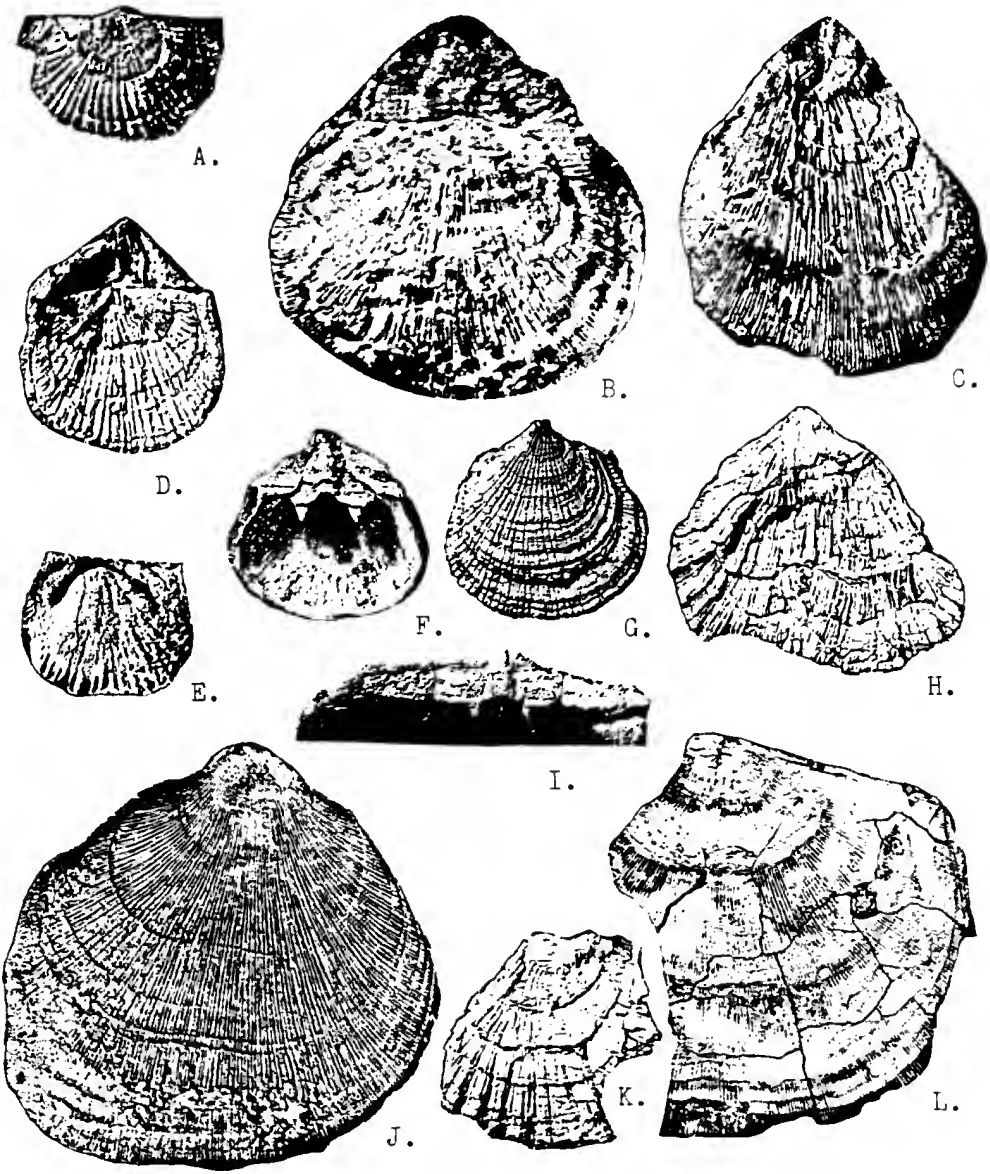

Fig.4. A, *Schuchertella* sp., x 2, Bowen Basin. B & C, *Streptorhynchus pelicanensis*, x 1, Bowen Basin. D & E, *Notostrophia bifurcata*, x 2 & x 1, Bowen Basin. F & G, *Arctitreta plicatilis*, x 2, Carnarvon Basin. H & K, *Kiangsiella condoni*, x 1, Carnarvon Basin. I & L, *Derbyia hardmani*, x 1, Canning Basin. J, *Streptorhynchus luluigui*, x 1, Canning Basin.
Figures from Thomas (1958), Dear (1971), & Waterhouse (1986).

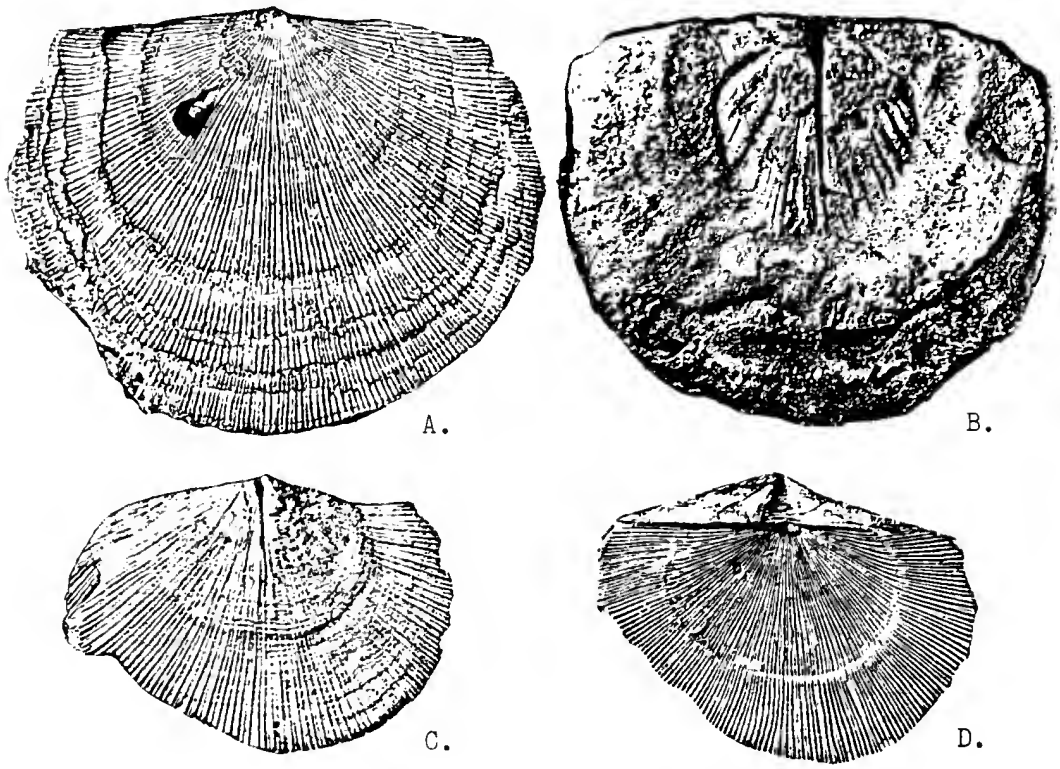

Fig.5. *Permorthotetes lindneri*, x 1, all from Canning Basin. Figures from Thomas (1958).

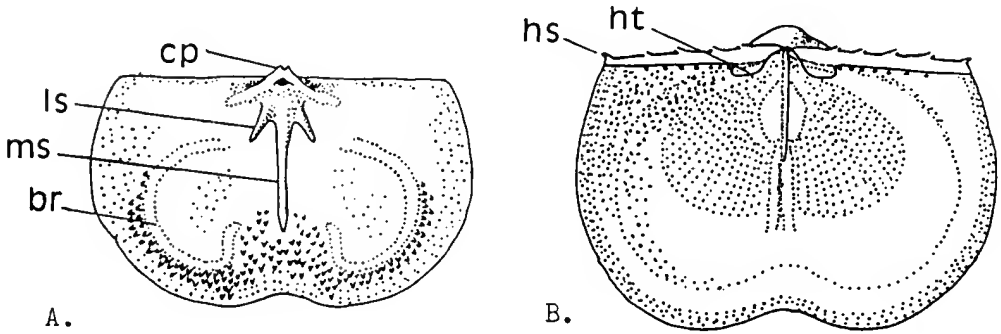

Fig.6. Internal morphology of *Neochonetes*. A, dorsal interior. B, ventral interior. cp = cardinal process, ls = lateral septum, ms = median septum, br = brachial ridge, hs = hinge spine, ht = hinge tooth. Figure from Archbold (1981b).

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AUSTRALIAN PERMIAN BRACHIOPODS (Cont.)


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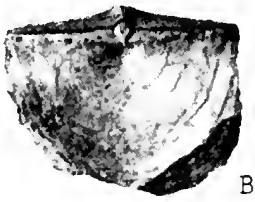
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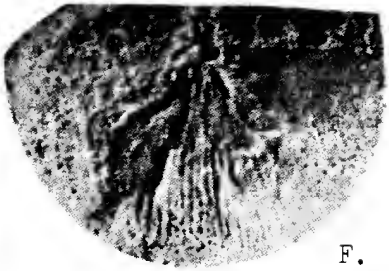
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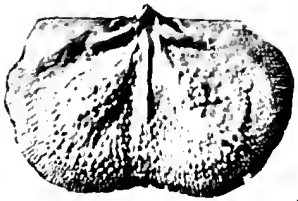
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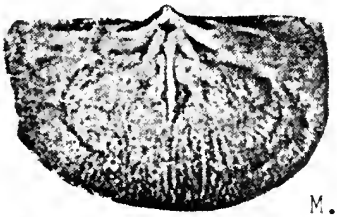
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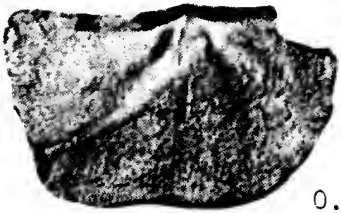
O.


P.

basins; present with some four genera in the Bowen Basin; rare with only one genus in the Sydney Basin and absent from Tasmania. The group was clearly sensitive to cool and cold temperatures.

The following genera have been recorded or described from Australian Permian faunas, see (fig.7).

Tornquistia	: In excess of four species known from W.A., (Carnarvon and Canning Basins).
Demonedys	: One rare species known from the Carnarvon Basin.
Quinquenella	: One species known from the Carnarvon Basin.
Svalbardia	: Two species from W.A., and one species from the Bowen Basin.
Neochonetes	: In excess of seven species from W.A., and one species from the Bowen Basin.
Chonetinella	: A possible species from W.A.
Waagenites	: Two very rare species from the Late Permian of W.A., (Canning and Bonaparte Basins).
Capillonia	: At least one species from the Bowen Basin.
Tivertonia	: One species from the Bowen and Sydney Basins.

References describing the chonetids include Archbold (1980,1981b, 1986), Dear (1971) and Waterhouse (1986).

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Fig.7. (left) A & B, *Tornquistia occidentalis*, x 3·5, Carnarvon Basin. C & F, *Quinquenella australis*, x 4 & x 4·5, Carnarvon Basin. D & E, *Demonedys granti*, x 3·5, Carnarvon Basin. G, H & I, *Svalbardia narelliensis*, x 3, Canning Basin. J, *Neochonetes (Sommeriella) pratti*, x 2, Perth Basin. K, *Neochonetes (Sommeriella)* sp., x 3, Canning Basin. I, *Chonetinella* sp., x 3·75, Carnarvon Basin. M & N, *Capillonia solida*, x 2, Bowen Basin. O & P, *Tivertonia yarrolensis*, x 2·6, Sydney Basin. Figures from Archbold (1980, 1981a, 1986) and Dear (1971).

DORIC, IONIC, CORINTHIAN & "AMMONITE" ! by Frank Holmes

What, you might well ask, has the ammonite got to do with the Greek Doric, Ionic and Corinthian Orders of Architecture?

Well, history tells us that after the Romans had added the Tuscan and Composite Orders to form the five classical Roman Orders, they disappeared from use for nigh on 1,000 years, staying in abeyance as it were, until the beginning of the Renaissance movement, when they again came to prominence as major design elements of western architecture. Then towards the end of the Late Renaissance, designs based on the ammonite were incorporated into the facades of fashionable Regency houses in the English County of Sussex. These designs, known today as the "Ammonite Order" of architecture, features pilasters (rectangular piers projecting from the face of a wall) with capitals whose volutes were cast in the form of large ammonites, clearly as a variation on the classical Ionic capitals that date back to 7th century B.C. It has been suggested that the Ionic Order itself may have been based on the natural spiral of the nautilus shell observed by some pre-Christian Greek Architect.

According to Michael Bassett in his book "Formed Stones, Folklore and Fossils", engravings suggest that the "Ammonite Order" originated in London and was devised in 1789 by an architect named George Dance who used it to decorate the front of the former Shakespeare Gallery in Pall Mall. Regrettably this building was demolished over 100 years ago.

Bassett goes on to note that a builder-cum-architect named Amon Wilds from the County town of Lewes in Sussex, became *attracted by the "Ammonite Order" as much by the punning allusion to his Christian name as by its architectural merit*, and sometime between 1810 and 1815 incorporated it into the facade of Nos. 2 and 3 Castle Place, Lewes.

Whether by coincidence or design, the association of these houses with the world of fossils did not

166 High Street, Lewes, with "Ammonite" capitals at top of pilasters. Note: Porch (added later) has Ionic capitals.

end there; for in 1816, No.3 Castle Place was bought by a young doctor named Gideon Algernon Mantell who devoted much of his life to the study and collection of fossils.

Three years later, Mantell also bought the adjoining house, No.2 and had the pair converted into a single dwelling (now known as 166 High Street).

It was while he was practising medicine in Lewes that his wife Mary Ann, who had accompanied him on a visit to a patient in the Cuckfield district of Sussex, discovered in a pile of road metal a piece of rock in which were embedded teeth of an unknown saurian, later named by Mantell, *Iguanodon*, because of the similarity of the teeth with those of the living lizard *Iguana*.

Mantell went on to write several popular books on fossils and geology as well as acquiring an extensive collection of fossils, referred to by Charles Lyell in 1833 as "a monument of original research and talent".

The use of the "Ammonite Order" did not cease with the two houses in Lewes, as Amon Wilds and his architect son moved to Brighton in 1815 where they formed a partnership with Charles Augustus Busby and were *responsible for much of the creation of "Regency Brighton" during the 1820's and early 30's, the ammonite capitals virtually becoming a trade mark of the firm.*

The association between Lewes and ammonites does not end with their use as a form of architectural decoration, as specimens of Cretaceous, Lower Chalk genera such as *Schloenbachia*, *Acanthoceras* and

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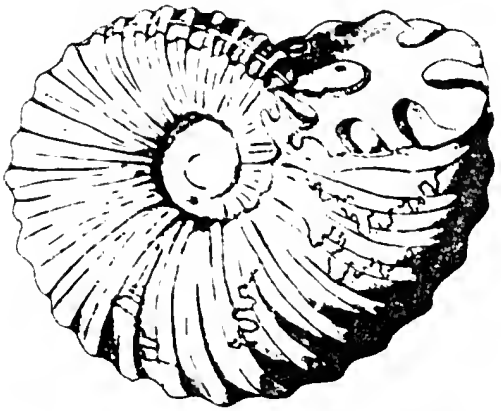
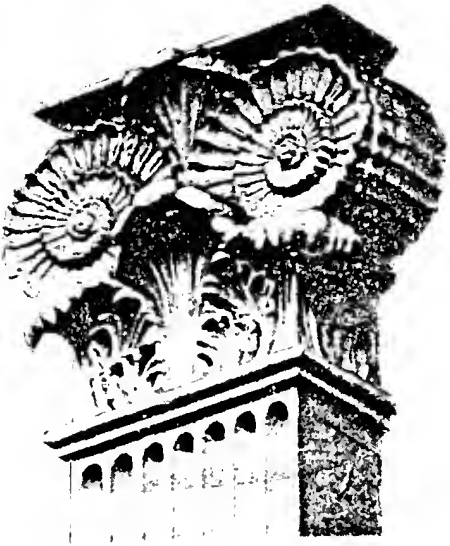


Above: Drawing by Mary Ann Mantell of *Mantelliceras mantelli* (J.Sowerby).



Right: Detail of "Ammonite" capital, 166 High Street, Lewes, Sussex.

DORIC, IONIC, CORINTHIAN & "AMMONITE" ! (Cont.)

Turrilites are recorded from an old quarry on the Eastbourne Road about 1 mile (1.6 kms) S.E. of the town.

In addition Mary Ann Mantell was quite an accomplished illustrator of local fossils as can be seen from her drawing on the previous page of *Mantelliceras (Mantelliceras) mantelli* (J.Sowerby, 1814).

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DINOSAUR COVE - A 1987 UPDATE

The following article is an edited version of the report by Dr. T.H. Rich on the 1987 "Dig at Dinosaur Cove". The F.C.A.A., wishes to thank Dr. Rich for permission to use this material.

Background

As most of you will know Dinosaur Cove is a fossil locality on the coast of Victoria, southeastern Australia, about 13 kms N.W. of Cape Otway. Since the first major excavation took place in 1984 (refer Bulletin 14, pp 11-15) the area has produced a small variety of Early Cretaceous fossil vertebrates approximately 110 million years old. Among these are at least three different ornithopod dinosaurs, flying reptiles or pterosaurs, acquatic plesiosaurs, turtles, lungfish and bony fish.

Within the cove are three distinct fossil sites, Dinosaur Cove West, Dinosaur Cove East, and Slippery Rock. Initial testing of the latter site, discovered in 1985, suggested it was richer than the other two, consequently most of excavation effort the following year was devoted to this particular deposit.

By undermining the fossiliferous layer where it was exposed for 9 metres along the cliff face, an advance of 75 centimetres was made in 1986. From this volume of rock, most of the 1024 specimens collected that year were recovered. This was more than twice the number of specimens that had been recovered the previous year at Dinosaur Cove, demonstrating the relative richness of the site. Equally attractive was the fact that the fossils tended to be

smaller vertebrates, closer in size on average to that expected of Early Cretaceous birds and mammals than those found at the other two sites.

By the end of the work at Slippery Rock in 1986, it was evident that further digging by undermining the entire length of the exposed fossiliferous rock was no longer feasible. With each advance, the danger of roof collapse increased. It was therefore, decided that narrower tunnels would be put in above the fossiliferous layer to allow removal of the fossils in the floor of the tunnel by conventional means.

The 1987 Excavation

Having secured the services of a volunteer mine manager and an underground shot firer, thanks to an anonymous donor making possible the placement of an advertisement in a major newspaper, setting up camp at Dinosaur Cove began on 5th January.

With the advent of tunnelling by means of explosives, there were several preliminary tasks that had to be accomplished before driving into the rock itself could begin. Eleven days were required to accomplish such things as constructing a powder magazine for storage of the gelignite and dislodging those rocks above the Slippery Rock site which appeared likely to fall after repeated shaking once blasting was underway.

Initially, the plan called for two tunnels to be simultaneously driven in parallel to one another. One was to be at the western extreme of the fossiliferous layer (West Tunnel) and the other 6 metres to the east (East Tunnel). Because access to the East Tunnel was the more difficult of the two and problems with getting started at the West Tunnel were formidable enough, excavation of the former was soon temporarily abandoned.

Due to the need for much experimentation to determine the most favourable pattern for placing explosives on the face, the amount of gelignite required for each blast and the method of detonation, it was several days before a proper tunnel was defined. Even then refinements were necessary right through to the end of tunnelling in late February, due in part to the changing character of the rock as the tunnels became deeper and the amount of weathering the rock had undergone, became less.

The initial phase of the excavation in the West Tunnel was further frustrated by the foul weather and consequent high seas which resulted in work being called off on four days and terminated early on others.

Once the excavation technique had evolved in digging the West Tunnel

Cont...

DINOSAUR COVE - A 1987 UPDATE (CONT.)

to the point where reasonable progress was being made, a second, successful attempt to start the East Tunnel was carried out.

With the completion of the West Tunnel on 26th January, an attempt to find fossils there was begun. It was disappointing in the extreme. Only a small area of less than 1 square metre at the mouth yielded any fossils as the floor was taken up. For the remainder of the 6 metres excavated, there was not a bone scrap to be seen. This contrasted quite markedly with the results on the rock face outside. Immediately east of the West Tunnel opening, exquisitely preserved partial skeletons of fish were recovered together with a partial jaw of a hypsilophodontid dinosaur. Apparently the West Tunnel had been placed 1 metre too far west.

On 10th February, the East Tunnel was completed. Taking up the floor, bone fragments were found for the first two metres inward from the mouth and then the fossil layer pinched out. At this stage, it appeared likely that fossils would be found only close to the surface.

Two days later, excavation began for the Cross Tunnel between the East and West Tunnels. Completed on 21st February, little was found at first, however, two days later (the fiftieth day of the 1987 excavation) fossils started turning up in abundance in the Cross Tunnel. On the third day, a partial skull of a small dinosaur was found in two pieces about 20 centimetres apart, followed the next day by two segments of vertebrae, one of which was later discovered to be associated with a partial hind limb. This was the first partially articulated dinosaur skeleton from Dinosaur Cove.

Once it was realised that the floor of the Cross Tunnel was relatively rich in fossils, it was decided to continue the work at Dinosaur Cove for another week to enable the entire fossiliferous layer to be collected. It was thought that if excavation was left to a later date the sea might rip up this layer and it would be lost forever.

Not all the 1987 excavation took place at the Slippery Rock site. A one metre wide strip was also removed from the west side of the Dinosaur Cove East site to reveal a number of fossil bones. The fossiliferous layer at this latter site appears to continue still further westward, but as it is plunging into the cove it presents progressively more formidable problems in keeping out the ocean. Any more work on the west side of Dinosaur Cove East will require a major effort to construct a dike. On the other hand to the east the fossiliferous layer rises above sea level eliminating the

problems of drainage.

With the help of the Friends of the Otways National Park Association, the camp was packed up and the collecting gear hauled out in four days, finishing on 8th March. As with the setting up, this was done for the most part in drizzling to pouring rain.

Results of the 1987 Excavation

The partial dinosaur skeleton found on the fifty-first day of the excavation is about 25 percent complete and only the fourth one from anywhere in Australia. The skull of which about half is preserved, is only the second dinosaur skull known from Australia. The teeth suggest it is one of the small, bipedal ornithopods so common among southern Victorian dinosaurs, but rare elsewhere. It could be another species or perhaps referable to one already recognised at Dinosaur Cove.

Preliminary analysis suggests this skull is quite unusual in that the brain is about ten times the volume to be expected for a reptile. This makes it about as large as one would expect for a bird or mammal with a skull of the same size. While there are a few small saurischian dinosaurs, thought to be closely related to birds, which have brains of this relative size, no ornithischian with this feature was known until discovery of this skull.

What is now Dinosaur Cove was within the Antarctic Circle when the animals, the fossils of which are now being found, lived and died there. It has been suggested that the enlarged brain was an adaptation to enhance the visual, olefactory, and (or) auditory powers of the animal to enable it to cope with the problems of surviving in a habitat that would therefore have experienced three months or more of darkness annually.

Cont...

Looking down on dinosaur skull found at Dinosaur Cove, February, 1987. Approx. 2·3 times natural size. Note the natural cast of the brain at the right (posterior) end of the skull.

DINOSAUR COVE - A 1987 UPDATE (CONT.)

Quite in contrast to this advanced feature of the brain, this dinosaur is unusual in the opposite respect. It possesses small teeth on the palate, interior to the main tooth row on the margin of the skull. Although some of the most primitive archosaurs (the group that gave rise to the dinosaurs more than 200 million years ago) possessed such palatal teeth, no other dinosaurs are known to have had such a primitive feature.

This analysis is naturally a very preliminary one and when comparisons are eventually made with other ornithischian dinosaurs in overseas museums, it will undoubtedly be modified and refined.

Besides this partial skull and skeleton, the front one-third of a jaw as well as about half a dozen isolated teeth of dinosaurs were also found at Slippery Rock. In addition there were numerous isolated dinosaur bones together with partial skeletons of four or five fish. Among these was part of the pelvis of a dinosaur, probably larger than any other yet found in Dinosaur Cove. Altogether, more than 600 specimens were catalogued. While this was less than the 1024 catalogued in 1986, the quality of the material was higher on average. This was due mainly to the fact that many of the fossils were found in claystone rather than exclusively in the clayball-rich sandstone. Fossils that were buried in what is now the claystone came to rest in extremely quiet water, the currents being so weak that they were incapable of moving even sand grains. In contrast the clayball-rich sandstones were deposited at the bottom of streams with much faster flowing water which tended to break apart the skeletons as well as individual bones. This discovery of claystones which yielded the fossil vertebrates was one of the most significant features of the 1987 dig because it offers the potential for recovering more specimens as exquisitely preserved as the one dinosaur skeleton found during this season's efforts.

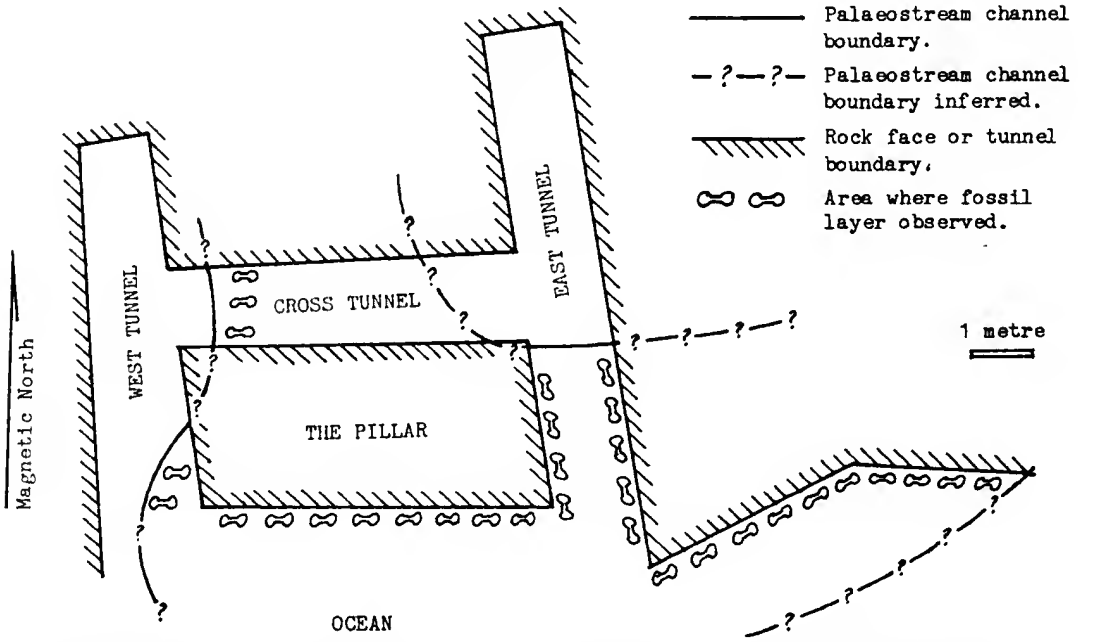
In order to follow the ancient stream channels to best advantage, it is now clear that tunnelling above them using explosives to remove the overburden is the only effective manner in which to proceed. There are no longer known productive sites within Dinosaur Cove where any less laborious approach is possible. Those that did exist have now been exhausted or for other reasons present technical difficulties greater than those of tunnelling. Therefore, the fact that a group of people now exist who have firsthand experience in the problems of tunnelling for the purpose of excavating fossil vertebrates in the often harsh conditions at Dinosaur Cove, is one of the foremost gains of the 1987 field season. Just as the 1984 dig provided the basis of experience upon which the 1985 and 1986 excavations were based, this latest effort will form the basis for subse-

quent digs where tunnelling using explosives will be the strategy employed.

As the tunnels at the Slippery Rock site were excavated, note was taken of its detailed geology. This indicates that the ancient stream, which deposited the fossiliferous rock at this site, made a 90° bend, turning from an east-west to a north-south heading. At the outside of this bend is where most of the fossils occurred. The East and West Tunnels neatly straddled the stream channel while the Cross Tunnel cuts a perfect section across it. The known extent of the fossiliferous rock is shown in figure 2. Just how far the ancient fossil bearing stream channel deposit may extend northward from the Cross Tunnel is uncertain. It could go for hundreds of metres or be cut off within ten centimetres by a joint or subsequent channel.

Summary

The winning of fossiliferous rock was much slower than had been anticipated, based on the experience of previous years. One of the main reasons for this was the fact that the East and West Tunnels were only 6 metres apart, which meant that when loading of explosives and blasting were being done in the former, it was unsafe to work in the latter. In addition, when the Panther rock drill was in operation drilling holes for explosives in the East Tunnel, it



STREAM CHANNEL GEOMETRY HYPOTHESIS, SLIPPERY ROCK SITE, DINOSAUR COVE, VICTORIA.

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DINOSAUR COVE - A 1987 UPDATE (CONT.)

required all the compressed air resources available on the site leaving nothing for the airtools being used in the West Tunnel.

This led to the frustration of the many people who had come primarily to break up the fossiliferous rock. Ironically, it did result in them breaking up a lot of rock generally considered to be devoid of fossils resulting in some fish material being found that otherwise would never have been recovered.

Future Direction

Major excavations have now taken place at Dinosaur Cove during the four successive summers of 1984 through 1987. With the discovery of the exquisite partial dinosaur skull and skeleton, a specimen of world class quality in the state of its preservation, the next sensible move at Dinosaur Cove is obvious. What will be done is to attempt to follow the ancient stream channel at the Slippery Rock site northward from the Cross Tunnel. If it disappears, then the final phase of the operation at the Slippery Rock site will be to remove the pillar of rock between the Cross Tunnel and the ocean because that is known to have yielded partial fish skeletons in claystone on one side and a dinosaur skull and skeleton on the other in the same kind of rock.

A second course of action will be to put in a series of drives eastward from the existing tunnel at Dinosaur Cove East. This will give access to the fossiliferous rock there which has yielded much material in the past. With the expertise now acquired in tunnelling, this is a reasonable approach to take to exploit this site.

It is proposed that the next excavation at Dinosaur Cove be during the first three months of 1989 if funding and volunteers can be found. In order to allow the scientific evaluation of the specimens already collected, no excavation will take place at Dinosaur Cove in 1988. In the meantime, funding will be sought to pay for the preparation of specimens by technicians, illustration of the fossils by a scientific illustrator, and comparison of the Dinosaur Cove material with similar dinosaurs housed in Europe, Asia and North America.

OVERSEAS MEMBER WISHES TO TRADE

Gerd Trost, Gerricusplatz 4, 4000 Duseldorf 12, Bundesrepublik Deutschland, would like to obtain Australian Palaeozoic brachiopods, particularly Devonian. As exchange he can offer material of similar age from Germany, Belgium, France and the U.K. as well as Mesozoic ammonites and Tertiary molluscs etc.

BOOKS & BOOK REVIEWS

"THE DINOSAUR HERESIES" by Robert Bakker

Published by Longman,1987, pp 481, U.K. price £14.95.

The idea that dinosaurs were warm-blooded in an avian or mammalian sense and unlike reptiles maintained a constant internal temperature by a high metabolic rate, was first put forward by Robert Bakker almost 20 years ago.

It stimulated a great deal of interest and was important in that it started a genuine re-evaluation of ideas on dinosaurs culminating in a symposium of the American Association for the Advancement of Science, the proceedings of which were published in 1980 under the title "A Cold look at the Warm-blooded Dinosaurs".

Although Bakker still expounded the hypothesis of endothermic archosaurs, the rest of the scientific community came down strongly in favour of dinosaurs being "passively" warm-blooded inertial homiotherms maintaining a constant internal temperature by virtue of their size. Nevertheless in many ways the debate changed peoples views on other aspects of dinosaurs.

Now seven years later, Bakker in his book "The Dinosaur Heresies" has again raised the matter of warm blooded dinosaurs.

Beverly Halstead writing in the New Scientist (6th August,1987) states that Mammal loyalists seem to be wildly enthusiastic about the book while on the other hand dinosaur workers are less than happy. He believes the book is destined to be tremendously popular with people unfamiliar with the dinosaurs controversy.

"PREHISTORIC AUSTRALIA" by Brian Mackness

Published by Golden Press, 1987. Recommended retail price $39.95.

In this book the author has tried to cover the history of Australian fossil invertebrates as well as that of the vertebrates. Unfortunately, according to Neil Archbold in a recent book review, Brian Mackness has devoted only four pages to introduce the reader to the geological time scale, a description of the origin of the Earth, continents and oceans and to outline the theory of plate tectonics, an understanding of which are essential if the reader is to appreciate the full splendour of the history of life in Australia.
In the area of fossil invertebrate history, many invertebrate groups attracting international interest in terms of evolution studies are given little space. In addition the treatment of rocks and fossils of certain geological periods, such as the Permian and Tertiary, is

Cont...

"PREHISTORIC AUSTRALIA" (Cont.)

often poor. This with the lack of any kind of maps could give the wrong impression as to the extent of many fossiliferous deposits in Australia.

On the positive side there are numerous well executed illustrations and reconstructions of various vertebrate fossils such as fish, dinosaurs, marsupials and giant flightless birds, all of which provide vivid views of past life. Regrettably, however, there are no evolutionary diagrams of the relationships between the various fossil organisms.

In spite of the criticisms, it is encouraging to see a new book on the Australian continent's history of life, especially in 1987, given today's emphasis on short term applied science by economy-driven politicians and the rise of powerful anti-science movements based on biblical fundamentalism. It is a pity the central theme of evolutionary history in Australia has not been fully developed.

Neil Archbold's detailed review of the book on which the above report is based, was published in the "Times on Sunday", 22nd November, 1987.

"EXTINCTION" by Steven M. Stanley.

Scientific American Library. An imprint of Scientific American Books,Inc., New York, 1987.
Distributed by W.H. Freeman & Co., pp242, $74.90 (Aust.)

The great extinctions that have punctuated the history of life on earth have attracted widespread attention, primarily because of humans' fascination with dinosaurs.

In this book Steven M. Stanley presents an authoritive analysis of the geologically brief global outbreaks of mass extinction, investigating what the rich storehouse of rock and fossil clues can tell us about their origins, progress and implications.

He explains how these mass extinctions differ from the background extinctions that are a continuous force in nature and evaluates the evidence that continental drift has triggered lethal changes in ocean circulation, sea level, and climatic patterns.

The highly publicised hypothesis that a meteor, comet or other extraterrestrial object might have served as an agent of catastrophe is also examined in detail.

After reconstructing each of the mass extinctions, Stanley concludes that strong geological evidence points to global climatic change as the most vital single factor behind these

rare, devastating and seemingly inevitable events.

It is an enthralling book, easy to read and with the visual appeal and clarity that goes with the "Scientific American Library" series.

Unfortunately, the high price (in Australia) is a reflection of the weakness of our currency and the loading we seem to be forced to pay for overseas publications with a limited local market. This is one book that should at least be on the shelf of your local library.

Steven M. Stanley is Professor of Paleobiology and Director of Graduate Studies in the Department of Earth and Planetary Sciences at Johns Hopkins University, Baltimore, U.S.A.

"ARCHAEOPTERYX, THE PRIMORDIAL BIRD"
by Fred Hoyle and Chandra Wickramasinghe.

Published by Christopher Davis, 1979, pp 135, U.K. price £10.95.

The main thrust of this book is a wild thesis by the authors, that lithographic limestone was ground up into a paste and then had modern feathers pressed into it to transform a fossil dinosaur *Compsognathus* into the first bird *Archaeopteryx*.

The accusation that the British Museum's specimen of *Archaeopteryx* is a fraud seems to overlook the fact that there are four other specimens of the fossil known, all bearing feathers and all found at different times over a period of 101 years. According to a review by noted vertebrate palaeontologist Beverly Halstead in New Scientist (10th September,1987), the authors seem determined to ignore whatever evidence is provided in rebuttal to their outlandish claims and to portray what seems to be a hatred of Charles Darwin and his theory of evolution and a most involved and twisted mentality towards palaeontologists.

Halstead notes that the book falls into three distinct parts which can be categorised as follows :-

1. The bee-in-the-bonnet hypothesis of evolution by viral invasion or genetic storm,
2. Monumental ignorance of geology, palaeontology and the preservation of fossils and
3. Calumny against dead scientists, their works and ideas.

It would appear to be a book that will do nothing to help the cause of true investigative science and only succeed all be it indirectly, in assisting the cause of creationism by providing more "learned" quotes.

"INVERTEBRATE FOSSILS" R.S. Boardman, A.H. Cheetham and A.J. Rowell (eds.)

Published by Blackwells, U.S., U.K., and Australia,1987, pp 713, $99(Aust.).

This new American textbook with 27 authors has taken about 10 years to come to fruition. It is the most up-to-date scientific publication on fossil invertebrates, references being made to papers well into the 1980's. Organisation of the book has been thoroughly researched and although primarily designed to fit into the American university system, it is equally valid elsewhere.

The first 65 pages discuss aspects of palaeontology, invertebrate organisation, ecology-palaeontology, evolution, preservation, classification and biostratigraphy and palaeobiogeography. The remainder of the book (650 pages), except for a section on the Kingdom Protista, deals with the animal phyla and trace fossils and includes a 40 page index allowing the book to be used as a textbook and a reference book.

Actual photographs are used to supplement the superb line drawings which include examples from all over the world including Australia.

The book uses a biological approach to palaeontology, an approach so often rejected by many teachers.

According to a recent review (see below), the result is very pleasing and should take palaeontology into the 21st century.

A full review of the book by R.E. Wass, Department of Geology and Geophysics, University of Sydney, is given in "The Australian Geologist" Newsletter No.65, December 20th, 1987.

'GEOLOGY OF VICTORIA'

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A completely re-written and revised volume on Victoria's geology will be available again in mid-1988. The original editors, Dr Jack Douglas and Dr Lex Furguson, have obtained the help of 25 high-calibre Victorian geologists who have substantially re-written the 1976 edition with six completely new chapters.

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